Remarks

Claims 1-15 are pending in the present application. The indication that claims 2, 5, 9 and 11 are directed towards allowable subject matter is greatly appreciated.

Claims 1, 3, 4, 6-8, 10 and 12-15 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Yamagata (US 6,822,447 B1).

Claims 3, 4, 8 and 9 have been amended.

Claim 16 has been added.

Claims 1, 2, 5-7 and 10-15 remain in the application unamended.

THE PRESENT APPLICATON

The present application relates to sensing the position of subject table or other movable subject support used in diagnostic imaging. Typically, such systems require a position, or motion, control system by which a subject is transported on a subject support into, and positioned within, the imaging volume. However, mechanical and control system errors tend to contribute to low levels of position accuracy and repeatability problems when producing images.

In light of this, an embodiment of the present invention includes a movable subject support 52 for moving a subject within the examination region. In one embodiment, the subject support is a wheeled table or other movable support that is adapted to mechanically dock with the magnetic resonance imaging apparatus. In another embodiment, the subject support is integrated with an MRI system and is movable therein. Regardless of the type of support, the subject support is movable for positioning the subject within the examination region.

The position of the support 52 is controlled by the position controller 60. In one embodiment, the position controller 60 includes a motor drive and linkage to the patient support which controls the position of the patient support as is known by one of ordinary skill in the art. Alternately, a drive pinion, pulley system, stepper motor, or the like controls the position of the table.

As described more fully in the application, the MRI apparatus also includes a position sensor, or encoder, 53 for directly detecting the position of the subject support with respect to a given reference frame. In one embodiment, the position sensor includes a graduated scale 54 disposed on the subject support and first (or

coarse) and second (or fine) read heads 55, 56 disposed on the MRI housing 13 to make such direct measurement.

THE YAMAGATA REFERENCE

Yamagata, on the other hand, teaches that when performing positioning of the region of diagnosis with the center O of the magnetic field (static magnetic field or gradient magnetic field) a manual or motorized mechanical means is used to automatically perform approximate positioning of the tabletop 6. For this reason, the MRI apparatus of the second embodiment has a system controller 14a, a T/R unit 15, a patient couch controller 16a, a magnetic gradient power supply 17, a position sensing unit 52, a 3-dimensional position sensor transmitter 53, and a 3-dimensional position sensor receiver 55. As shown in FIG. 13, the T/R coil 19 that is attached to the region of diagnosis of the patient P has the 3-dimensional (or 2-dimensional) position sensor transmitter 53 mounted to it. A 3-dimensional position sensor receiver 55 is mounted, for example, at the center of the linking section 12 (position corresponding to directly above the magnetic field center O). The 3-dimensional position sensor receiver 55 receives position information that is sent from the 3-dimensional position sensor transmitter 53. The position sensing unit 52 accepts the position information of the 3-dimensional position sensor transmitter 53 that was received at the 3-dimensional position sensor receiver 55, and sends this information to the system controller 14a. The system controller 14a sends the position information of the 3-dimensional position sensor transmitter to the patient couch controller 16a. The patient couch controller 16a calculates the difference (distance) components between the position information of the 3-dimensional position sensor transmitter 53 that was sent from the system controller 14a and the position information of the center O of the static magnetic field and gradient magnetic field, and controls the patient couch 2 so as to move the tabletop 6 by the amounts indicated by these difference components. See, Yamagata, column 8, line 40 – column 9, line 7.

THE CLAIMS DISTINGUISH OVER THE PRIOR ART OF RECORD

Claim 1 is directed to An MRI apparatus comprising a main magnet for generating a main magnetic field in an examination region; a plurality of gradient magnets for generating magnetic field gradients in the main magnetic field; a radio frequency coil for

transmitting radio frequency signals into the examination region and exciting magnetic resonance in a subject disposed therein; a radio frequency coil for receiving the magnetic resonance signals from the subject; a subject support for supporting the subject; a position controller for controlling the position of the subject support within the examination region; and a position sensor for directly measuring the position of the subject support.

Applicants respectfully submit that Yamagata does not teach or suggest all of the limitations of claim 1. As set forth more fully above, Yamagata teaches that the T/R coil 19 that is attached to the region of diagnosis of the patient P has the 3-dimensional (or 2-dimensional) position sensor transmitter 53 mounted to it. A 3-dimensional position sensor receiver 55 is mounted, for example, at the center of the linking section 12 (position corresponding to directly above the magnetic field center O). The 3-dimensional position sensor receiver 55 receives position information that is sent from the 3-dimensional position sensor transmitter 53. Accordingly, Yamagata teaches directly measuring the position of the T/R coil. With respect to the patient support, at best, Yamagata teaches an indirect relationship with its position sensor transmitter and receiver. Accordingly, Yamagata does not teach or suggest a position sensor for directly measuring the position of the subject support as set forth in claim 1.

In light of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection of claim 1.

Claims 3 and 4 have been amended to more appropriately depend from claim 1, rather than claim 2.

Claims 3, 4 and 6 ultimately depend from claim 1. For at least the reasons set forth above in connection with the patentability of claim 1, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 3, 4 and 6.

Claim 7 is directed to an MRI apparatus comprising: main field means for generating a main magnetic field in an examination region; gradient means for generating magnetic field gradients in the main magnetic field; radio frequency transmit means for transmitting radio frequency signals into the examination region and exciting magnetic resonance in a subject disposed therein; radio frequency receive means for receiving magnetic resonance signals from the subject; subject support means for supporting the subject; position control means for controlling the position of the subject support within

the examination region; and position sensing means for directly measuring the position of the subject support.

The reasons stated above in connection with the patentability of claim 1 can be applied *mutatis mutandis* to claim 7. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claim 7.

Claims 8 and 9 have been amended to appropriately depend from claim 7.

Claims 8, 10 and 12 ultimately depend from claim 7. For at least the reasons set forth above in connection with the patentability of claim 7, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 8, 10 and 12.

Claim 13 is directed to an MRI method comprising the steps of: generating a main magnetic field in an examination region; generating magnetic field gradients in the main magnetic field; transmitting radio frequency signals into the examination region for exciting magnetic resonance in a subject disposed therein; receiving magnetic resonance signals from the subject; controlling the position of a subject support within the examination region; and directly measuring the position of the subject support.

The reasons stated above in connection with the patentability of claim 1 can be applied *mutatis mutandis* to claim 13. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claim 13.

Claim 16 has been added and is directed to a diagnostic imaging apparatus comprising: an examination region for receiving a subject to be examined; a subject support for supporting the subject within the examination region; a position controller for controlling the position of the subject support within the examination region; and a position sensor for directly measuring the position of the subject support, wherein a first portion of the position sensor is disposed on at least one of: i) the subject support; and ii) a generally fixed location with respect to the diagnostic imaging apparatus; and a second portion of the position sensor is disposed on at least one of: i) the subject support; and ii) a generally fixed location with respect to the diagnostic imaging apparatus and opposite the first portion of the position sensor.

It is respectfully submitted that claim 16 is patentable over the prior art of record for at least the reasons set forth above in connection with claim 1.

Conclusion

Applicants submit that claims 1-16 distinguish patentably and non-obviously over the prior art of record and are in condition for allowance. An early indication of allowability is earnestly solicited.

If any fees are due in connection with this Response, the authorization to charge deposit account 14-1270 for the fees associated therewith is hereby provided.

Respectfully submitted,

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